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FROM THE JOURNAL OF HYGIENE, Vol. V. No. 3, JULY 1905.



CAMBRIDGE  
AT THE UNIVERSITY PRESS.





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## THE PREVALENCE OF TRICHOCEPHALUS DISPAR.

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No investigations seem to have been made in recent years as to the prevalence of intestinal worms among the general population in this country. The present results are derived from the microscopical examination of the stools of 500 in-patients of Guy's Hospital. The cases were taken consecutively by beds all through the hospital, without any selection, over a period of ten months, and comprise surgical and medical as well as gynaecological and other special patients. Nearly all were inhabitants of London.

The method of examination was to shake up a small portion of the faeces with normal saline solution in a test-tube; after allowing the mixture to sediment for about half-an-hour the supernatant fluid is poured off and the deposit shaken up with fresh saline. This process is repeated four or five times, and by it all the finer *débris* is removed; one drop of the final deposit containing the eggs in a concentrated form is mounted fresh, and any eggs present are readily detected under a low power. The method is chiefly of value where very few eggs are present. In such cases eggs are often found where a negative result has been obtained in the direct examination of the unwashed faeces. Unless the time allowed for sedimentation is unreasonably curtailed, there is no danger of eggs being lost during the washing. In more than four-fifths of the cases each sample was examined independently by two observers, the whole of the deposit under a  $\frac{7}{8}$  in. square cover-glass being searched methodically on a mechanical stage.

Eggs of parasites were found in 40 cases; in one *Ascaris* eggs were discovered with difficulty in a boy aet. 6, who had been admitted to the

hospital as a case of *Ascaris* infection; in the remaining 39 eggs of *Trichocephalus dispar* were found. We did not meet with the eggs of any other parasite. The following table shows the details of these cases with regard to age distribution:

Age	Total cases examined	Cases in which eggs were found	Percentage infected
0—5	42	1	2·4
5—10	43	5 (+ 1 <i>Ascaris</i> )	11·9
10—20	86	9	10·5
20—30	96	12	12·5
30—40	58	7	12·1
40—50	69	3	4·4
50—60	51	2	4·0
60—70	19	0	0
over 70	3	0	0
age not given	33	0	0
	500	39 + 1 <i>Ascaris</i>	7·8

These figures indicate a well-marked susceptible period of life; 84 p.c. of the infections fall between 5 and 40, while but 5·7 p.c. of the cases examined come within that age period. The absence of infections in children is striking; the single case in the period 0–5 years was aged 4, so that in the first four years of life we have 41 cases with no infections<sup>1</sup>.

The sex incidence is equal: of 279 males 22 (= 7·9 p.c.), and of 221 females 17 (= 7·7 p.c.), were found to be infected.

As might be expected, nothing suggestive is found in the diseases with which *Trichocephalus* was associated. Roughly speaking 45 p.c. of the infected patients were medical, 30 p.c. surgical, 7 p.c. gynaecological, and 10 p.c. were suffering from affections of the eyes. Of 24 cases of appendicitis, two (8·3 p.c.) had worms; as this is rather less than the average incidence (9·4 p.c.) in all the cases of the same age period, no support is afforded to the notion that *Trichocephalus* has any aetiological relationship to appendicitis<sup>2</sup>. The length of time between the patients' admission to the hospital and the discovery of eggs varied from 2 to 103 (average 27) days. In no case were the eggs numerous, and in the majority not more than 1 to 3 were found in a drop of the washed faeces.

<sup>1</sup> The presence of *Oxyuris* is often missed by the ordinary methods of examination of faeces. We have had the opportunity of comparing in a number of cases the results of the microscopical examination of faeces with a subsequent microscopical search for the adult worms after the administration of thymol. In the former the eggs or worms were seen extremely seldom, while in the latter specimens of *Oxyuris* were nearly always found.

<sup>2</sup> Metchnikoff, *Bull. de l'Acad. de Méd.* vol. XLV. 1901, p. 301.

The results have indeed no pathological interest; they indicate rather the extent to which the general population in London comes into contact with human faeces. The life-history of *Trichocephalus dispar* is not elucidated in all detail, but the essential facts seem to be fully established. The eggs measure about 55 by 25  $\mu$ , and as they leave the host in the stools contain an undifferentiated ovum; further development is very slow and many months are occupied in the growth of the larva within the egg. This growth is to some extent independent of temperature and will take place at "room-temperature" in this country. The thick egg-shell is very resistant; in consequence the embryo can survive great vicissitudes of temperature and moisture, and may remain capable of development for a long time (up to five years—Davaine) after leaving the body. The larva does not escape from the egg outside the body, but only on being taken into the alimentary canal. Eggs which do not contain a developed larva are not infective. As far as is known, infection can only take place *per os*. The length of life of the adult worm in the human intestine is, we believe, quite unknown; analogy would lead us to suppose that it may extend to several years.

Monkeys and lemurs are said to be often infected with *T. dispar*; in this country, however, this is of no moment in the present connection. Closely allied, but distinct, species are found in several of the domestic animals—notably *T. crenatus* in the pig and *T. affinis* in the sheep. The eggs of these other species very closely resemble those of *T. dispar*, but the specificity of worm infections practically precludes the suggestion that the eggs which we have found in human stools are other than those of *T. dispar*, and that the infections with this worm had their origin in faeces other than human<sup>1</sup>.

It follows from this that infection arises by the ingestion of material contaminated with stale human faeces. Immediate personal infection or reinfection is excluded by the fact that the eggs must go through a lengthy period of development outside the body before they become infective. Any interest which our result may have lies in the demonstration—which is we believe unequivocal—that all the precautions which are taken in this country to secure the safe disposal of human excreta have not been adequate to prevent a purely faecal infection being present in at least 8 p.c. of the population<sup>2</sup>.

<sup>1</sup> It is possible, though hardly credible, that the eggs found might have been the eggs of some other species of *Trichocephalus* which had been swallowed and passed through the body as such. In any case, the infection must be faecal whether it be human or animal.

<sup>2</sup> It follows from the long duration of the infection that this figure is to some extent an accumulated result, and possibly also partly the result of conditions now past.



On the other hand it is satisfactory to note that these results indicate a far more efficient cleanliness than do similar statistics from other places, a selection of which follows:

Place	Number examined	Percentage with <i>Trichocephalus</i>
Erlangen <sup>1</sup>	1755	11.1
„ (insane) <sup>1</sup>	138	100
Dresden <sup>1</sup>	1939	2.5
Kiel <sup>1</sup>	1117	32.2
Dublin <sup>2</sup>	90	90
Greenwich <sup>2</sup>	16	69
Paris <sup>3</sup>	?	50
Naples <sup>3</sup>	80	100
Bâle <sup>4</sup>	752	23.6
United States (insane) <sup>5</sup>	500	10.8
Porto Rico <sup>6</sup>	5490 (?)	6 +
Cornish Miners <sup>7</sup>	48	79
India <sup>8</sup>	1249	4.4
„ <sup>9</sup>	?	90

The cause and nature of the infection are such that, apart from variations in the method and thoroughness of the examination, the degree of infection must vary quantitatively with the degree of faecal contamination. This can be estimated directly only by an intimate knowledge of the details of the habits of the people concerned. The only instance which has come under our personal observation fully supports the connection: Cornish miners have hitherto worked in very filthy surroundings and are infested with worms. Many of the statistics quoted refer to the experience of some thirty years ago, and it may well be that much improvement has taken place since then.

As far as our own cases are concerned, the paths of infection cannot be definitely traced; the absence of the worm in young children<sup>10</sup>

<sup>1</sup> Leuekart, *Transl. Hoyle*, 1. 1887, p. 151.

<sup>2</sup> Cobbold, *Parasites*, 1879, p. 179.

<sup>3</sup> C. Davaine, *Traité des Entozoaires*, 1877, p. 209.

<sup>4</sup> Blanchard, *Traité de Zoologie Médicale*, 1889, 1. p. 783.

<sup>5</sup> Bull. no. 13, Hyg. Lab., U.S. Pub. Health and Mar.-Hosp. Serv., Washington, 1903; other statistics will be found here.

<sup>6</sup> Report of Commission on "Anemia" in Porto Rico, San Juan, 1904.

<sup>7</sup> This *Journal*, iv. 1904, p. 477; subsequent experience has fully confirmed this figure.

<sup>8</sup> Dobson, *Report on Ankylostomiasis*, 1892.

<sup>9</sup> Hektoen and Riesman, *Pathology*, 1. 1901, p. 344.

<sup>10</sup> This point is brought out in the Erlangen statistics (children 4.8, adults 13.1 p.e.), but not in those from Kiel (children 32.5, adults 29.5 p.e.). Blanchard, *Traité de Zool. Méd.* 1.

suggests somewhat strongly that infection is brought about by the injection of "ordinary" food, since in other ways children would appear

Sex and age	Disease	Differential leucocyte count : Percentages					
		Lympho- cytes	Inter- mediate	Large hyaline	Neutro- phile	Eosino- phile	Mast- cells <sup>1</sup>
M 36	aneurysm of aorta	9	15.5	19	55.5	<b>1</b>	0
M 39	chronic nephritis	27	21	6	42.5	<b>2.5</b>	1
M 31	crushed hand	21	19.5	3.5	53.5	<b>1</b>	1.5
M 12	mastoid disease	14	9	6.5	68.5	<b>2</b>	0
M 24	hip disease	14.5	11	6.5	63.5	<b>4</b>	0.5
M 25	acute rheumatism	21.2	20.2	3.2	51.6	<b>3.8</b>	0
M 25	detached retina	23.5	15.5	14.5	45.5	<b>1</b>	0
M 23	acute pericarditis	23.4	10.4	1.2	61.4	<b>3.2</b>	0.4
M 48	hemiplegia	28	11	2	56.5	<b>1.5</b>	1
M 28	mitral disease	31	12	3	53.5	<b>0.5</b>	0
M 16	sciatica	36.5	11	1.5	47	<b>3.5</b>	0.5
M 52	hemiplegia	23	17	2	56	<b>2</b>	0
M 7	empyema	12.5	5	1.5	80.5	<b>0.5</b>	0
M 20	detached retina	28	15	4.5	46.5	<b>4.5</b>	1.5
M 24	sight failure	25	16.5	8.5	49	<b>1</b>	0
(M 6	<i>Ascaris</i>	34	7.5	6	49	<b>3.5</b>	0)
F 38	phthisis	22	8	2	66.5	<b>0.5</b>	1
F 19	endometritis	20	6	2	70	<b>1.5</b>	0.5
F 40	?	5.5	6.5	1.5	86	<b>0.5</b>	0
F 23	chlorosis	20	13	4	57	<b>5.5</b>	0.5
F 8	pneumonia	32	9.5	3.5	53	<b>2</b>	0
F 19	acute rheumatism	31.5	6	2	59	<b>1.5</b>	0
F 35	lupus	36	6	4.5	49	<b>3.5</b>	1
F 9	hip disease	27.5	8.5	2.5	57.5	<b>3</b>	1
F 11	acute rheumatism	46	7.5	4	41.5	<b>0.5</b>	0.5
F 23	gastric ulcer	23.5	6	2.5	62.5	<b>3.5</b>	2
F 16	exophth. goitre	40	6.5	2	50	<b>1.5</b>	0
		Av. <b>2.1</b>					

to be particularly liable to take in undesirable material. Among the common articles of diet, the readiest mode of infection is offered by uncooked vegetables, and perhaps especially by water-cress, which is eaten very commonly by the poorer classes in London, and which is often derived from sources which are open to the gravest suspicion of sewage contamination. The greater part, at any rate, of the London water is subjected to some sedimentation before delivery; as the eggs settle very quickly, this would seem to exonerate the water supply, apart from the influence of filtration<sup>2</sup>.

<sup>1</sup> Mast-cells were always present, though none were found in cells actually enumerated.

<sup>2</sup> Cf. Blanchard, *Archives de Parasitologie*, III. 1900, p. 485.



The opportunity has been taken of investigating the condition of the eosinophile leucocytes in some of the cases. The table on the preceding page of 26 cases confirms the opinion previously expressed<sup>1</sup> that *Trichocephalus* infection, at any rate of the mild degree which was here present, is not accompanied by an eosinophilia.

We have much pleasure in acknowledging the invaluable help which has been rendered by our laboratory assistant, J. R. Clark, in obtaining these results, which, without such efficient aid, would have been long delayed.

<sup>1</sup> This *Journal*, iv. 1904, p. 468.

